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(71) Applicant(s)
Daewoo Electronics Co., Ltd
(Incorporated in the Republic of Korea)
541 5-Ga Namdaemoon-Ro, Jung-Ku, Seoul,
Republic of Korea

(72) Inventor(s)
Sang-Hoon Lee

(74) Agent and/or Address for Service
Page White & Farrer
54 Doughty Street, LONDON, WC1N 2LS,
United Kingdom

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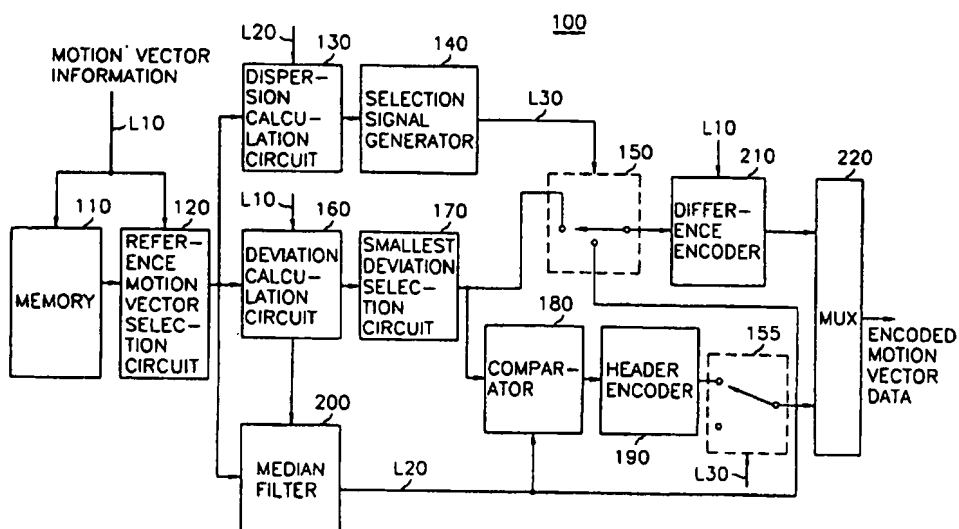UK CL (Edition O) H4F FGM
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(54) Abstract Title
Encoding motion vectors

(57) A current motion vector is encoded based on reference motion vectors by determining a first and a second predictors for the current motion vector. The first predictor 200 has a horizontal and a vertical component representing medians of the horizontal and the vertical components of the reference motion vectors 120, respectively, while the horizontal and the vertical components of the second predictor 160,170 represent a least horizontal and a least vertical component of the reference motion vectors which yield minimum differences from the horizontal and the vertical components of the current motion vectors. If the degree of dispersion 130,140 of the reference motion vectors is less than a predetermined threshold, the first predictor is set 150 as an optimum predictor of the current motion vector. If otherwise, the second predictor is regarded as the optimum predictor of the current motion vector. The current motion vector is encoded based on the optimum predictor by using the differential pulse coding technique 210 and the variable length coding scheme.

FIG.2

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FIG. 1
(PRIOR ART)

MOTION VECTOR INFORMATION

10 — MEMORY

20 — REFERENCE MOTION VECTOR SELECTION

30 — PREDICTOR DETERMINATION

40 — DIFFERENCE ENCODER

CODED MOTION VECTOR

FIG.2

100

MOTION VECTOR INFORMATION

L10

110

MEMORY

120

REFER-ENCE MOTION VECTOR SELEC-TION CIRCUIT

130

L20

DISPER-SION CALCU-LATION CIRCUIT

140

SELECTION SIGNAL GENERATOR

L30

150

210

L10

DIFFER-ENCE ENCODER

220

MUX

ENCODED MOTION VECTOR DATA

160

L10

DEVIATION CALCU-LATION CIRCUIT

170

SMALLEST DEVIATION SELEC-TION CIRCUIT

180

COMPAR-ATOR
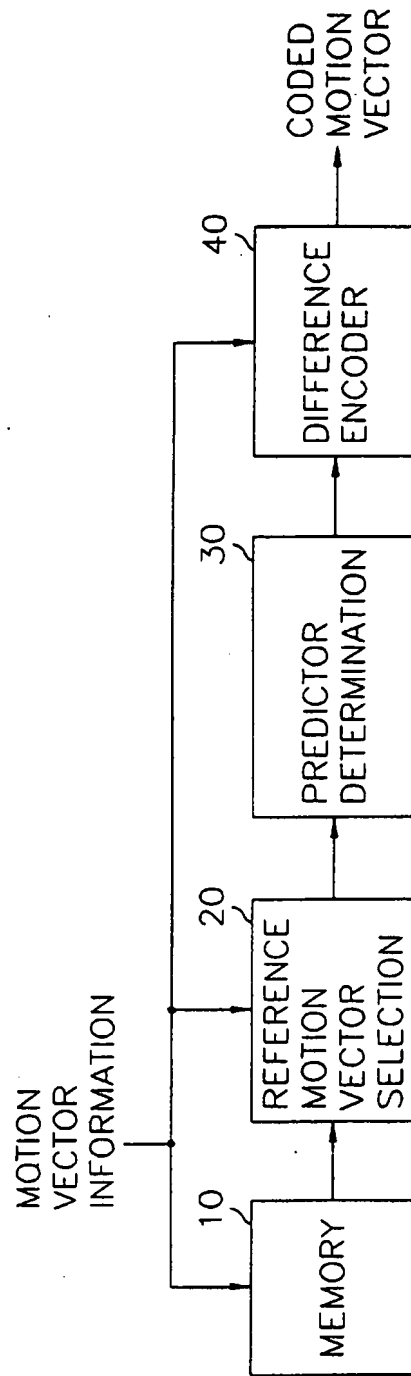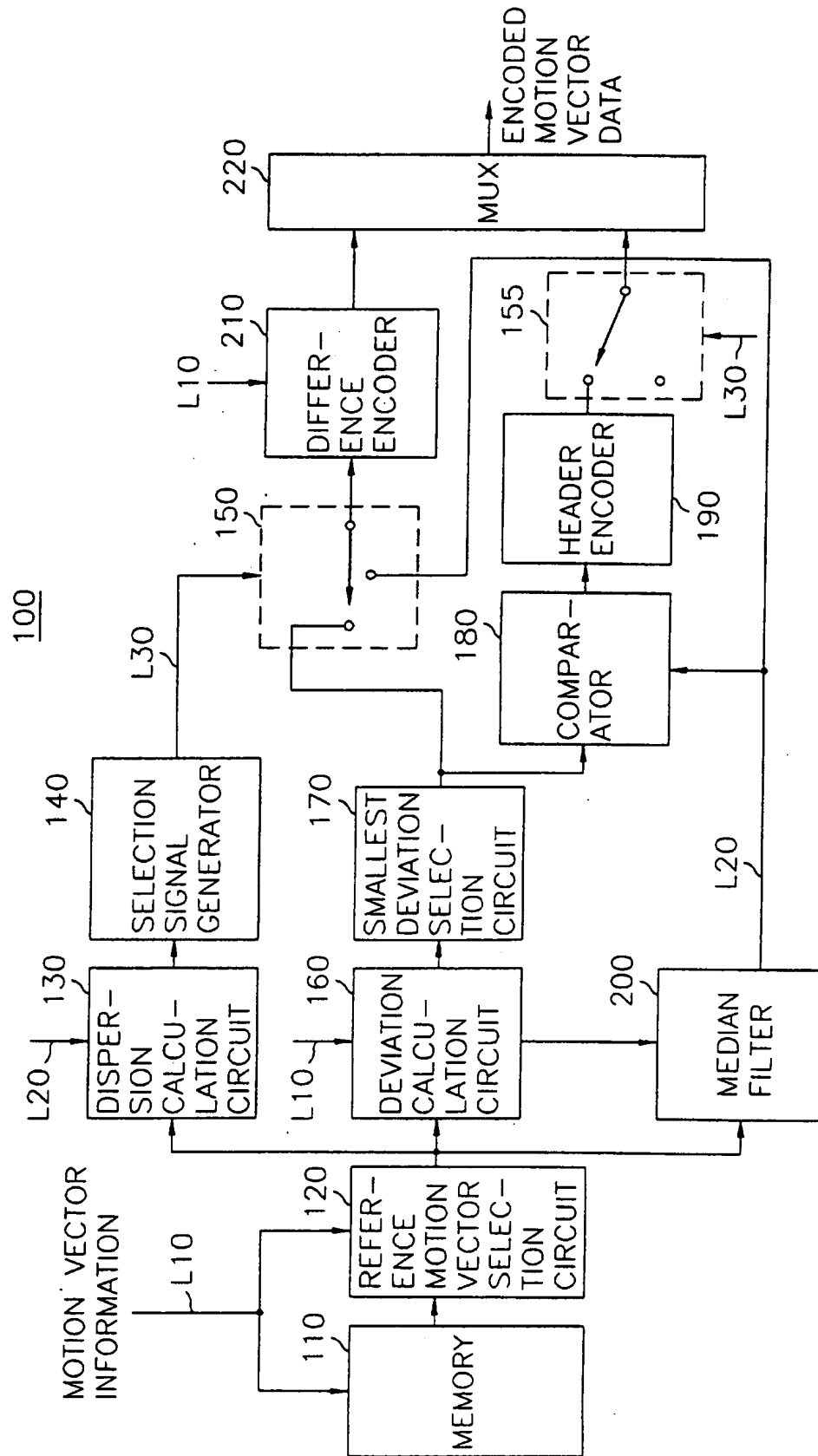
190

HEADER ENCODER

155

L30

200

MEDIAN FILTER

L20

METHOD AND APPARATUS FOR ENCODING A MOTION VECTOR

The present invention relates to a method and apparatus
5   for encoding a motion vector; and, more particularly, to a
method and apparatus capable of encoding a motion vector of a
search block based on a deviation from motion vectors of
reference blocks thereof.

10

In digitally televised systems such as a video-telephone,
a teleconference and a high definition television systems, a
large amount of digital data is needed to define each video
frame signal since a video line signal in the video frame
15   signal comprises a sequence of digital data referred to as
pixel values.   Since, however, the available frequency
bandwidth of a conventional transmission channel is limited,
in order to transmit the large amount of digital data
therethrough, it is necessary to compress or reduce the volume
20   of the data through the use of various data compression
techniques, especially in the case of such low bit-rate video
signal encoders as a video-telephone and a teleconference
systems. Among various video compression techniques, the so-
called hybrid coding technique, which combines temporal and
25   spatial compression techniques together with a statistical
coding technique, is known to be most effective.

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Most hybrid coding techniques employ a motion compensated DPCM(differential pulse coded modulation), two-dimensional DCT(discrete cosine transform), quantization of DCT coefficients, and VLC(variable length coding). The motion compensated DPCM is a process of estimating the movement of an object between a current frame and its previous frame, and predicting the current frame according to the motion flow of the object to produce a differential signal representing the difference between the current frame and its prediction.

Specifically, in the motion compensated DPCM, current frame data is predicted from the corresponding previous frame data based on an estimation of the motion between the current and the previous frames. Such estimated motion may be described in terms of two dimensional motion vectors representing the displacement of pixels between the previous and the current frames.

There have been two basic approaches to estimate the displacement of pixels of an object: one is a block-by-block estimation and the other is a pixel-by-pixel approach.

In the pixel-by-pixel approach, a displacement is determined for each and every pixel. This technique allows a more exact estimation of the pixel value and has the ability to easily handle scale changes and non-translational movements, e.g., scale changes and rotations, of the object. However, in the pixel-by-pixel approach, since a motion vector is determined at each and every pixel, it is virtually

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impossible to transmit all of the motion vector information to a receiver.

As for the block-by-block motion estimation, on the other hand, a current frame is divided into a plurality of search blocks. To determine a motion vector for a search block in the current frame, a similarity calculation is performed between the search block of the current frame and each of a plurality of equal-sized candidate blocks included in a generally large search region within a reference frame. An error function such as the mean absolute error or mean square error is used to carry out the similarity measurement between the search block of the current frame and one of the candidate blocks in the search region of the previous frame. And the motion vector, by definition, represents the displacement between the search block and a candidate block which yields a minimum error function.

Referring to Fig. 1, there is shown a schematic block diagram of a conventional apparatus for encoding a motion vector of a search block based on a median value of the motion vectors of neighboring search blocks.

Motion vector information for each search block of the current frame is sequentially inputted to a memory 10, a reference motion vector selection circuit 20 and a difference encoder 40, wherein the motion vector information for a search block includes position data of the search block within the frame and a motion vector thereof, the motion vector being

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represented by a horizontal and a vertical components thereof.

The memory 10 stores the motion vectors by using the position data thereof as their addresses.

The reference motion vector selection circuit 20 determines reference search blocks of a current search block based on the position data thereof and retrieves motion vectors of the reference search blocks from the memory 10, the reference search blocks having a predetermined positional relationship to the current search block. For instance, as disclosed in MPEG(Moving Pictures Expert Group)-4, Video Verification Model Version 7.0, ISO/TEC JTC1/SC29/WG11, MPEG97/1642, three blocks positioned at the left, the upper and the upper-right corners of the current search block can be determined as the reference search blocks. The motion vectors of the reference search blocks are provided to a predictor determination circuit 30 as reference motion vectors for the motion vector of the current search block("current motion vector"). In response to the reference motion vector, the predictor determination circuit 30 determines a predictor of the current motion vector and provides same to the difference encoder 40, wherein a horizontal and a vertical components of the predictor are medians of the horizontal and the vertical components of the reference motion vectors, respectively.

The difference encoder 40 finds directional differences between the current motion vector and the predictor thereof based on a DPCM(differential pulse code modulation) technique

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and encodes the differences by using, e.g., variable length coding(VLC) technique. The encoded differences are then transmitted to a decoder at a receiving end as an encoded motion vector of the current search block.

5   The process of encoding a motion vector of a search block based on a predictor thereof can effectively reduce the amount of data representing the motion vector, since the difference between a motion vector and a predictor thereof is normally smaller than the motion vector itself in most cases.

10   In certain cases, however, for instance, if reference motion vectors are of a large variation, the conventional predictor determination scheme based on the simple filtering described above may not produce an optimum predictor of a motion vector, resulting in a degraded coding efficiency.

15

      It is, therefore, a primary object of the invention to provide a method and apparatus capable of determining an optimum predictor of a motion vector, thereby improving the
20   coding efficiency of the motion vector.

      In accordance with one aspect of the present invention, there is provided a method for encoding a current motion vector based on a plurality of reference motion vectors, wherein each motion vector includes a first and a second
25   components, the method comprising the steps of:

      (a) finding a first predictor having a first and a second

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components, the first component of the first predictor representing a median of the first components of the reference motion vectors and the second component of the first predictor denoting a median of the second components of the reference

5   motion vectors;

(b) calculating first absolute differences between the first component of the current motion vector and the first components of the reference motion vectors, and second absolute differences between the second component of the

10   current motion vector and the second components of the reference motion vectors to thereby decide, among the first and the second components of the reference motion vectors, a least first component and a least second component which yield a least first absolute difference and a least second absolute

15   difference, respectively;

(c) determining a second predictor comprised of the least first and the least second components·decided in step (b);

(d)· generating a first and a second flag signals representing the first and the second components decided in

20   step (b), respectively;

(e) computing a dispersion value of the reference motion vectors .and comparing the dispersion value with a predetermined threshold to thereby generate a first selection signal if the dispersion value is less than the threshold and

25   a second selection signal if otherwise, the dispersion value indicating the degree of proximity among the reference motion

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vectors; and

(f) encoding the current motion vector based on the first predictor in response to the first selection signal, and the current motion vector based on the second predictor, as well as the first and the second flag signals, in response to the second selection signal, thereby generating encoded data of the current motion vector.

In accordance with another aspect of the present invention, there is provided a method for encoding a current motion vector based on a plurality of reference motion vectors, wherein each motion vector includes a first and a second components, comprising the steps of:

(a) finding a first predictor having a first component representing a median of the first components of the reference motion vectors and a second component denoting a median of the second components of the reference motion vectors;

(b) estimating a dispersion value of the reference motion vectors and comparing the dispersion value with a predetermined threshold, the dispersion value indicating the degree of proximity among the first and the second components of the reference motion vectors;

(c) if the dispersion value is smaller than the threshold, encoding the difference between the first components of the current motion vector and the first predictor and the difference between the second components of the current motion vector and the first predictor to thereby

generate the encoded differences as encoded data of the current motion vector; and

(d) if the dispersion value is equal to or greater than the threshold, generating encoded data of the current motion vector, including the steps of:

(d1) determining a second predictor having a least first component corresponding to one of the first components of the reference motion vectors which yield a minimum difference with respect to the first component of the current motion vector and a least second component corresponding to one of the second components of the reference motion vectors which yield a least difference with respect to the second component of the current motion vector;

(d2) obtaining a first and a second identification signals, the first and the second identification signals indicating the first component and the second component of the reference motion vectors to which the respective least first and second components of the second predictor correspond; and

(d3) encoding the difference between the first components of the current motion vector and the second predictor and the difference between the second components of the current motion vector and the second predictor together with the first and the second identification signals, thereby generating encoded data

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of the current motion vector.

In accordance with still another aspect of the present
invention, there is provided an apparatus for encoding a
current motion vector based on a plurality of reference motion
vectors, each of the motion vectors including a first and a
second components, comprising:

means for estimating a degree of dispersion of the first
and the second components of the reference motion vectors to
thereby issue a first selection signal if the degree of
dispersion is considered to be low and a second selection
signal if the degree of dispersion is regarded to be high;

means for determining a first predictor having a first
median and a second median as a first and a second components
thereof, wherein the first and the second medians represent
median values of the first and the second components of the
reference motion vectors, respectively;

means for obtaining a second predictor having a least
first and a least second components, wherein the least first
component of the second predictor corresponds to one of the
first components of the reference motion vectors which yields
a minimum difference with respect to the first component of
the current motion vector and the least second component of
the second predictor corresponds to one of the second
components of the reference motion vectors which yields a
least difference with respect to the second component of the
current motion vector;

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means for deciding the first and the second predictors as an optimum predictor in response to the first and the second selection signals, respectively; and

means for encoding the current motion vector based on the

5   optimum predictor.

The above and other objects and features of the present invention will become apparent from the following description

10   of preferred embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 shows a schematic block diagram of a conventional apparatus for encoding a motion vector of a search block based on a median of neighboring motion vectors; and

15   Fig. 2 presents a block diagram of an apparatus for encoding a motion vector of a search block in accordance with the present invention.

20   Referring to Fig. 2, there is shown a block diagram of an apparatus 100 for encoding a motion vector of a search block in accordance with the present invention, wherein the motion vector represents a displacement between the search block of a current frame and a candidate block within a corresponding

25   search region of a previous frame that yields a minimum error function. Motion vector information for each of the search

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blocks within a current frame is inputted to a memory 110, a reference motion vector selection circuit 120, a deviation calculation circuit 160 and a difference encoder 210 via a line L10, wherein the motion vector information represents

5   position data of a current search block and a motion vector thereof, the motion vector being represented by a horizontal and a vertical components thereof.

The memory 110 stores therein the motion vector for each search block by using the position data thereof.

10   The reference motion vector selection circuit 120 determines reference search blocks of a current search block based on position data thereof and retrieves motion vectors of the reference search blocks from the memory 110. In a preferred embodiment of the invention, three search blocks

15   positioned at the left, the upper and the upper-right of the current search block are selected as the reference search blocks in a same manner as in the MPEG-4 verification model 7.0 described above. In another instance of the invention, another set of reference search blocks, e.g., at the left, the

20   upper and the upper-left of the current search block can be selected as the reference search blocks. In any case, it is preferable to set the number of the reference search blocks to be an odd number in order to facilitate the median filtering the motion vectors thereof.

25   The motion vector for each of the reference search blocks, each motion vector being comprised of the horizontal and the

vertical components, is provided from the reference motion vector selection circuit 120 to a dispersion calculation circuit 130, the deviation calculation circuit 160 and a median filter 200 as the reference motion vector of the motion vector for the current search block.

The median filter 200 determines a median vector based on the reference motion vectors. A horizontal and a vertical components MV_MED_x and MV_MED_y of the median vector MV_MED are computed as:

$$MV\_MED\_x = \text{median } (MV_{1x}, MV_{2x}, \ldots\ldots, MV_{Nx})$$

$$MV\_MED\_y = \text{median } (MV_{1y}, MV_{2y}, \ldots\ldots, MV_{Ny})$$

wherein MV_{ix} and MV_{iy} are a horizontal and a vertical components of an i_{th} reference motion vector, i being $1, 2, \ldots\ldots, N$ with N being a total number of reference motion vectors. For instance, if N=3 and $MV_1 = (-2, 3)$, $MV_2 = (1, 5)$ and $MV_3 = (-1, 7)$, then MV_MED_x=-1 and MV_MED_y=5. The computed horizontal and vertical components of the median vector is provided to the dispersion calculation circuit 130, a switch 150 and a comparator 180 via a line L20 as a first candidate predictor of the motion vector of the current search block.

The dispersion calculation circuit 130 calculates a degree of dispersion with respect to the horizontal and the vertical components of the reference motion vectors around the median vector to provide same to a selection signal generator 140. In other words, the horizontal and the vertical dispersions DIS_x and DIS_y of the horizontal and the vertical

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components of the reference motion vectors are calculated as follows, respectively:

$$DIS\_x = \frac{1}{N} \sum_{i=1}^{N} (MV_{ix} - MV\_MED\_x)^2$$

$$DIS\_y = \frac{1}{N} \sum_{i=1}^{N} (MV_{iy} - MV\_MED\_y)^2$$

5   The selection signal generator 140 compares the sum of the horizontal and the vertical dispersions DIS_x and DIS_y with a predetermined threshold to generate a first or a second selection signal. If the sum is less than the predetermined threshold, the first selection signal is provided to the

10   switch 150 and a switch 155 via a line L30 and, if otherwise, the second selection signal is provided to the switches 150 and 155 via the line L30.

In the meantime, the deviation calculation circuit 160 calculates directional differences between the reference

15   motion vectors and the motion vector of the current search block, respectively. The directional differences may be defined as:

$$DIR\_DIF(i)\_x = |MV_{ix} - CMV_x|$$

$$DIR\_DIF(i)\_y = |MV_{iy} - CMV_y|$$

20   wherein DIR_DIF(i)_x(y) represents the difference between the horizontal(vertical) components of an i_{th} reference motion

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vector and the motion vector of the current search block("current motion vector") provided on the line L10 and CMV_x and CMV_y denotes the horizontal and the vertical components of the current motion vector CMV. Provided from the deviation calculation circuit 160 to a smallest deviation selection circuit 170 for each directional components MV_{ix} or MV_{iy} is a set of deviation data $(MV_{ix}, DIR\_DIF(i)\_x)$ or $(MV_{ix}, DIR\_DIF(i)\_y)$.

In response to the sets of deviation data from the deviation calculation circuit 160, the smallest deviation selection circuit 170 determines a smallest horizontal and vertical differences among $DIR\_DIF(i)\_x$'s and $DIR\_DIF(i)\_y$'s, respectively, and provides the switch 150 and comparator 180 with a second candidate predictor of the current motion vector, wherein the second candidate predictor is comprised of a least horizontal component corresponding to a horizontal components of the reference motion vectors which generates the smallest horizontal difference and a least vertical component representing the one which yields the smallest vertical difference. For instance, if N=3 and $MV_1=(-2,3)$, $MV_2=(1,5)$, $MV_3=(-1,7)$ and the current motion vector $MV_{curr}=(5,1)$, then the second candidate predictor $MV\_SEC=(1,3)$ is determined.

The comparator 180 compares the least horizontal and the least vertical components of the second candidate predictor with the horizontal and the vertical components of the first candidate predictor, respectively, and provides a horizontal

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and a vertical comparison results to a header encoder 190. The header encoder 190 generates a flag or an identification signal for each comparison result. For instance, if the least horizontal(or the least vertical) component of the second candidate predictor is equal to the horizontal(or the vertical) component of the first candidate predictor, a flag signal '0' is generated; if the least horizontal(or the least vertical) component of the second candidate predictor is smaller than the horizontal(or the vertical) component of the first candidate predictor, a flag signal '10' is generated; and if the least horizontal(or the least vertical) component of the second candidate predictor is greater than the horizontal(or the vertical) component of the first candidate predictor greater, a flag signal '11' is generated. For the instance given above, i.e., the first candidate predictor MV_MED=(1,5) and the second candidate predictor MV_SEC=(1,3), flag signals '0' and '10' are generated for the least horizontal and the least vertical components of the second candidate predictor, respectively. The pair of flag signals for the second candidate predictor is fed to the switch 155.

The switch 150 selects as an optimum predictor either the first candidate predictor fed from the median filter 200 or the second candidate predictor fed from the smallest deviation selection circuit 170 in response to the first or the second selection signal; and provides the optimum predictor to the difference encoder 210.

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The difference encoder 210 calculates, based on the conventional DPCM technique, the differences between the horizontal components and the vertical components of the current motion vector and those of the optimum predictor; and encodes the differences based on, e.g., the VLC technique. The encoded differences are provided to a multiplexor(MUX) 220 as a coded motion vector for the current search block.

The switch 155 provides the flag signals from the header encoder 190 to the MUX 220 if and only if the second selection signal is inputted thereto via the line L30. At the MUX 220, the coded motion vector from the difference encoder 210 and the flag signals, if provided from the switch 155, are multiplexed as encoded motion vector data for the current search block; and the encoded motion vector data is transmitted to a transmitter(not shown) for the transmission thereof.

At a decoder of a receiving end, the sum of the directional dispersion of the reference motion vector is calculated in an identical manner as in the dispersion calculation circuit 130. If the sum is less than the predetermined threshold, the motion vector of the current search block is reconstructed based on the median vector of the reference motion vectors and the transmitted coded motion vector. If the sum is not less the predetermined threshold, the motion vector of the current search block can be reconstructed based on the flag signals and the coded motion

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vector included in the transmitted motion vector data.

While the present invention has been described with respect to the particular embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

Claims:

1.   A method for encoding a current motion vector based on a
plurality of reference motion vectors, wherein each motion
vector includes a first and a second components, the method
comprising the steps of:

(a) finding a first predictor having a first and a second
components, the first component of the first predictor
representing a median of the first components of the reference
motion vectors and the second component of the first predictor
denoting a median of the second components of the reference
motion vectors;

(b) calculating first absolute differences between the
first component of the current motion vector and the first
components of the reference motion vectors and second absolute
differences between the second component of the current motion
vector and the second components of the reference motion
vectors to thereby decide, among the first and the second
components of the reference motion vectors, a least first
component and a least second component, respectively, which
yield a least first absolute difference and a least second
absolute difference, respectively;

(c) determining a second predictor comprised of the least
first and the least second components decided in step (b);

(d) generating a first and a second flag signals
representing the least first and the least second components

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decided in step (b), respectively;

(e) computing a dispersion value of the reference motion vectors and comparing the dispersion value with a predetermined threshold to thereby generate a first selection signal if the dispersion value is less than the predetermined threshold and a second selection signal if otherwise, the dispersion value indicating the degree of proximity among the reference motion vectors; and

(f) encoding the current motion vector based on the first predictor in response to the first selection signal, and the current motion vector based on the second predictor, as well as the first and the second flag signals, in response to the second selection signal, thereby generating encoded data of the current motion vector.

2. The method according to claim 1, wherein the dispersion value is defined as:

$$DIS = \frac{1}{N}\sum_{i=1}^{N} (MV_{i1} - MED_1)^2 + \frac{1}{N}\sum_{i=1}^{N} (MV_{i2} - MED_2)^2$$

wherein DIS represents the dispersion value; MV_{i1} and MV_{i2} denote a first and a second components of an i_{th} reference motion vector, respectively, i being 1 to N with N being the number of the reference motion vectors; and MED_1 and MED_2 are medians of MV_{i1}'s and MV_{i2}'s, respectively.

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3. The method according to claim 2, wherein N=3.

4. The method according to claim 3, wherein the first and the second flag signals indicate whether the least first and the least second components decided in step (b) are smaller than, equal to, or greater than the medians of the first and the second components of the reference motion vectors, respectively.

5. The method according to claim 1, wherein said encoding step (f) is carried out by a variable length coding technique.

6. A method for encoding a current motion vector based on a plurality of reference motion vectors, wherein each motion vector includes a first and a second components, comprising the steps of:

(a) finding a first predictor having a first component representing a median of the first components of the reference motion vectors and a second component denoting a median of the second components of the reference motion vectors;

(b) estimating a dispersion value of the reference motion vectors and comparing the dispersion value with a predetermined threshold, the dispersion value indicating the degree of proximity among the first and the second components of the reference motion vectors;

(c) if the dispersion value is smaller than the

predetermined threshold, encoding the difference between the first component of the current motion vector and the first predictor and the difference between the second component of the current motion vector and the first predictor to thereby generate the encoded differences as encoded data of the current motion vector; and

(d) if the dispersion value is equal to or greater than the threshold, generating encoded data of the current motion vector, including the steps of:

(d1) determining a second predictor having a least first component corresponding to one of the first components of the reference motion vectors which yield a minimum difference from the first component of the current motion vector and a least second component corresponding to one of the second components of the reference motion vectors which yield a least difference from the second component of the current motion vector;

(d2) obtaining a first and a second identification signals, the first and the second identification signals indicating a first component and a second component of the reference motion vector to which the least first and the least second components of the second predictor correspond, respectively; and

(d3) encoding the difference between the first component of the current motion vector and the least first component the second predictor and the difference

between the second component of the current motion vector and the least second component of the second predictor together with the first and the second identification signals, thereby generating encoded data of the current motion vector.

7. The method according to claim 6, wherein said determining step (d1) has the steps of:

(d11) calculating first absolute differences between the first component of the current motion vector and the first components of the reference motion vectors and second absolute differences between the second component of the current motion vector and the second components of the reference motion vectors;

(d12) selecting a least first and a least second components which yield a least first absolute difference and a least second absolute difference, respectively; and

(d13) deciding the second predictor comprised of the least first and the least second components selected in step (d12).

8. The method according to claim 6, wherein said encoding steps (c) and (d3) are carried out based on a variable length coding technique.

9. The method according to claim 6, wherein the dispersion

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value is defined as:

$$DIS = \frac{1}{N}\sum_{i=1}^{N} (MV_{i1} - MED_1)^2 + \frac{1}{N}\sum_{i=1}^{N} (MV_{i2} - MED_2)^2$$

wherein DIS represents the dispersion value; MV_{i1} and MV_{i2}
denote a first and a second components of an i_{th} reference
motion vector, respectively, i being 1 to N with N being the
number of the reference motion vectors; and MED_1 and MED_2 are
medians of MV_{i1}'s and MV_{i2}'s, respectively.

10.   The method according to claim 8, wherein N=3.

11. The method according to claim 9, wherein the first and the
second identification signals indicate whether the least first
and the least second components of the second predictor
correspond to a smallest, a median or a largest first and
second components of the reference motion vectors,
respectively.

12. An apparatus for encoding a current motion vector based on
a plurality of reference motion vectors, each of the motion
vectors including a first and a second components, comprising:
      means for estimating a degree of dispersion of the first
and the second components of the reference motion vectors to
thereby issue a first selection signal if the degree of
dispersion is considered to be low and a second selection

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signal if the degree of dispersion is regarded to be high;

means for determining a first predictor having a first median and a second median as a first and a second components thereof, wherein the first and the second medians represent median values of the first and the second components of the reference motion vectors;

means for obtaining a second predictor having a least first and a least second components, wherein the least first component of the second predictor corresponds to one of the first components of the reference motion vectors which yields a minimum difference from the first component of the current motion vector and the least second component of the second predictor corresponds to one of the second components of the reference motion vectors which yields a least difference from the second component of the current motion vector;

means for deciding the first and the second predictors as an optimum predictor in response to the first and the second selection signals, respectively; and

means for encoding the current motion vector based on the optimum predictor.

13. The apparatus according to claim 12, wherein said estimating means includes means for computing a dispersion value, the dispersion value being defined as:

$$DIS=\frac{1}{N}\sum_{i=1}^{N} (MV_{i1}-MED_1)^2+\frac{1}{N}\sum_{i=1}^{N} (MV_{i2}-MED_2)^2$$

wherein DIS represents the dispersion value; MV_{i1} and MV_{i2} denote a first and a second components of an i_{th} reference motion vector, respectively, i being 1 to N with N being the number of the reference motion vectors; and MED_1 and MED_2 are medians of MV_{i1}'s and MV_{i2}'s, respectively.

14. The apparatus according to claim 13, wherein said estimating means further includes:

means for comparing the dispersion value with a predetermined threshold; and

means for generating the first selection signal if the dispersion value is smaller than the predetermined threshold and the second selection signal if otherwise.

15. The apparatus according to claim 14, wherein said means for obtaining the second predictor includes:

means for generating a first difference between the first component of the current motion vector and each first component of the reference motion vectors and a second difference between the second component of the current motion vector and each second component of the reference motion vectors, the first and the second differences being defined as:

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$$DIR\_DIF(i)\_x = |MV_{ix} - CMV_x|$$

$$DIR\_DIF(i)\_y = |MV_{iy} - CMV_y|$$

wherein DIR_DIF(i)_x represents a first difference between a first component of an i_{th} reference motion vector and a first component of a current motion vector, i being 1 to N with N being the number of the reference motion vectors; DIR_DIF(i)_y, a second difference between a second component of the i_{th} reference motion vector and a second component of a current motion vector; MV_{ix}, the first component of the i_{th} reference motion vector; MV_{iy}, the second component of the i_{th} reference motion vector; CMV_x and CMV_y being the first and the second components of the current motion vector, respectively;

means for finding the minimum difference among the first differences and the least difference among the second differences; and

means for producing the second predictor having a least first component yielding the minimum difference and a least second component relating to the least difference as the first and the second components thereof.

16. The apparatus according to claim 15, wherein N=3.

17. The apparatus according to claim 16, further comprising means for generating a first and a second flag signals, the

first flag signal indicating whether the first component of
the second predictor is smaller than, equal to or greater than
the first median and the second flag signal indicating whether
the second component of the second predictor is smaller than,
equal to or greater than the second median.

18. The apparatus according to claim 17, wherein said means
for encoding the current motion vector includes means for
coding the flag signals in response to the second selection
signal.

19. The apparatus according to claim 18, wherein said encoding
means further includes means for encoding the current motion
vector by using a differential pulse code modulation technique
and a variable length coding scheme.

20. A method for encoding a motion vector substantially as
herein described with reference to or as shown in Figure 2
of the accompanying drawings.

21. Apparatus constructed and arranged substantially as
herein described with reference to or as shown in Figure 2
of the accompanying drawings.

Application No: GB 9717793.5 **Examiner:** John Coules
Claims searched: 1-21 **Date of search:** 20 October 1997

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Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

    UK Cl (Ed.O): H4F FGM

      Int Cl (Ed.6): H04N 5/14

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	EP 0624981 A2 (Sharp)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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GB2343579

Publication Title:

Hybrid-linear-bicubic interpolation method and apparatus

Abstract:

Abstract of GB2343579

The invention relates to a method for reducing the computational overhead of bicubic interpolation while still providing a similar level of accuracy. The invention takes into account the fact that sampled points surrounding a point whose value is to be determined have respective first, second and third order effects on the calculated value. The invention combines linear interpolation, ignoring points having a third order effect, with cubic interpolation of points having a first and second order effect to derive the value.

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